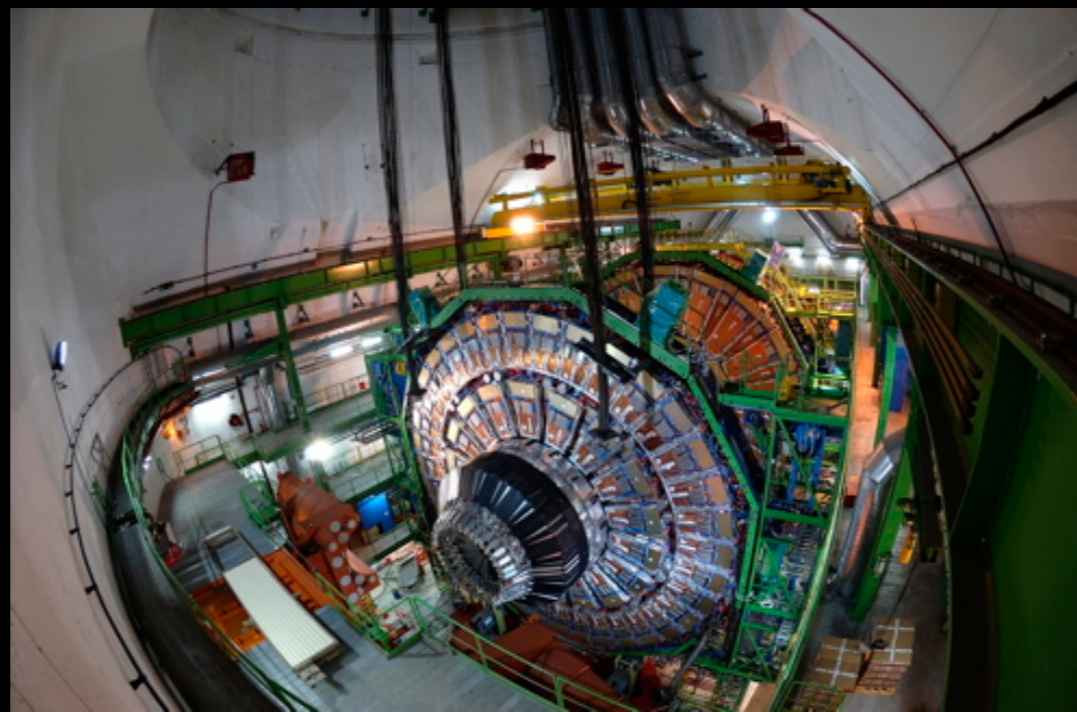


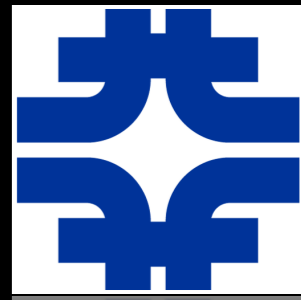
Analyzing Millions of Gigabyte of LHC Data for CMS

-

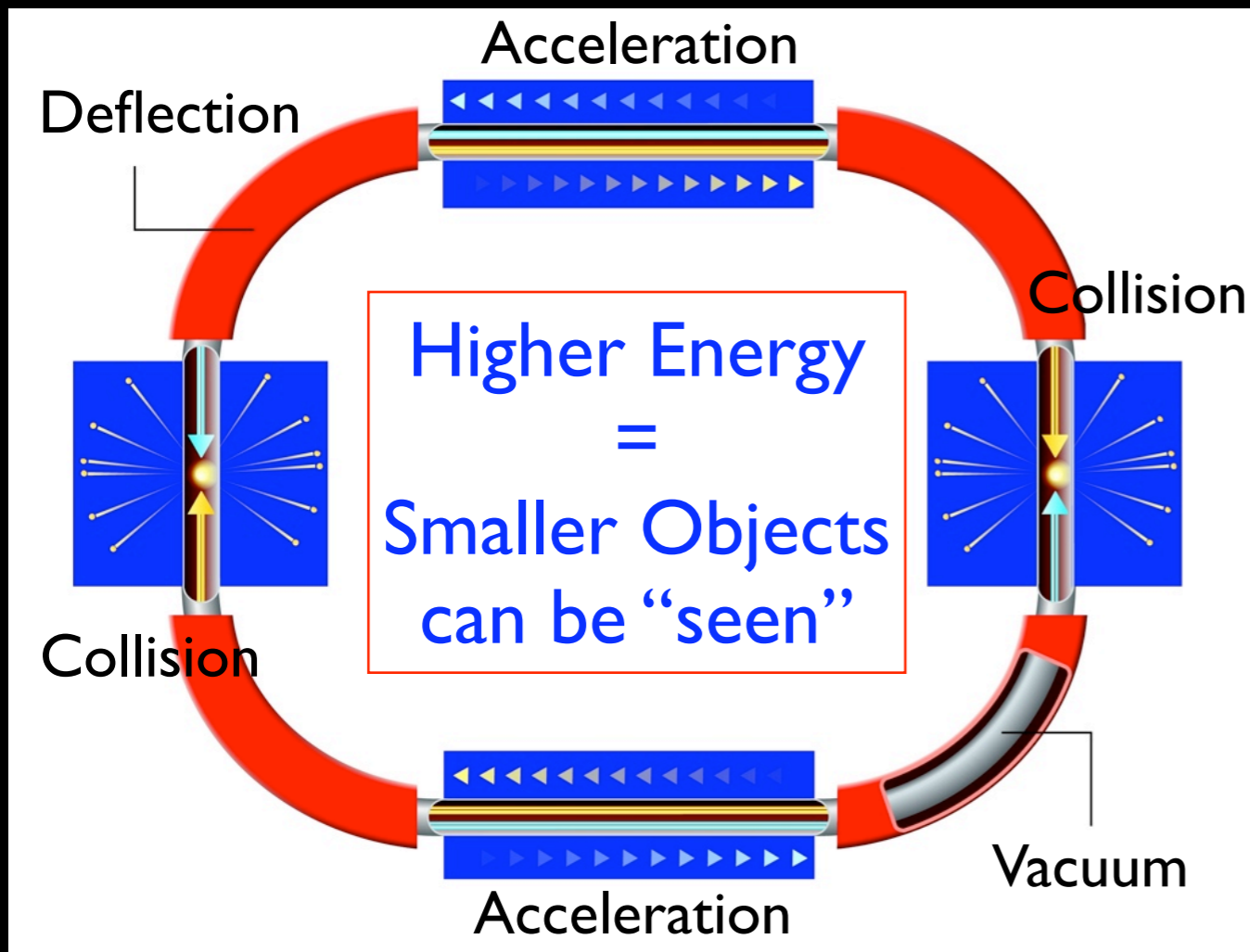
Discover the Higgs on OSG



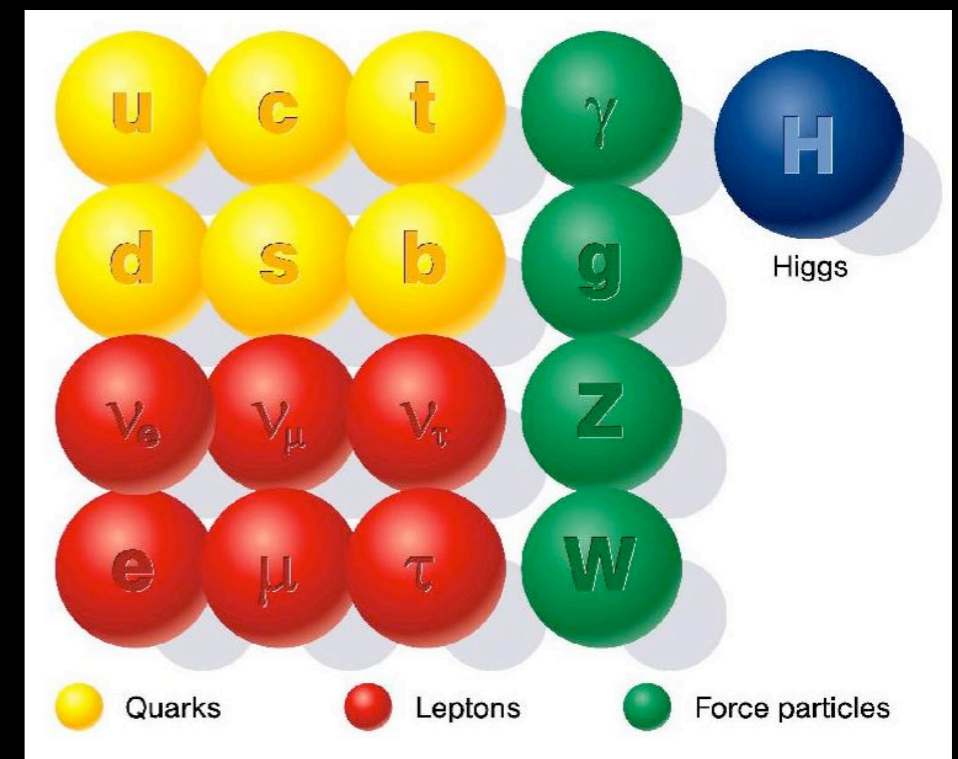
Oliver Gutsche - CMS / Fermilab



Particle Physics



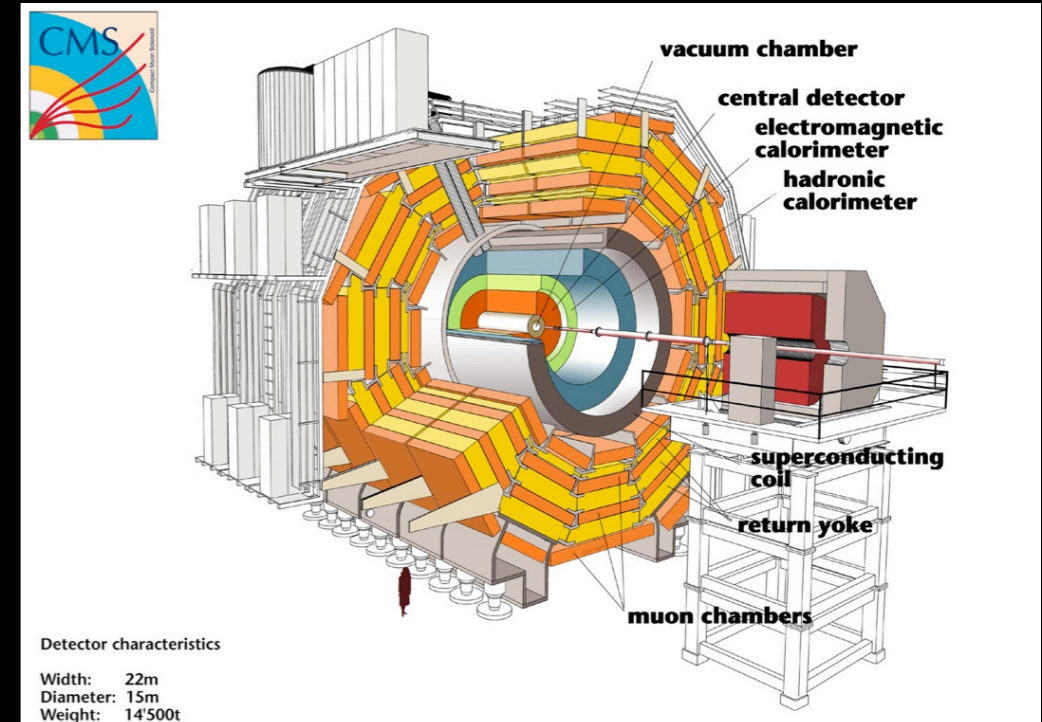
- Describe structure of matter using mathematical concepts: **Standard Model**
- **Higgs**: concept to describe mass of particles
- not discovered yet \Rightarrow LHC



- Investigate structure of matter by
 - Colliding elementary particles
 - Detecting collision products

LHC and CMS

- **Large Hadron Collider** at CERN, Geneva, Switzerland
 - Proton-Proton collisions
 - Beam energy: 7 Terra Electron Volts
 - ➔ 40 t truck hitting wall at 90 MPH
- Circumference: 27 km



Detector characteristics

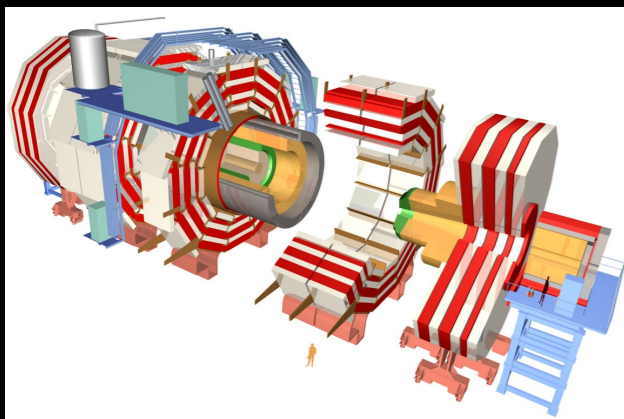
Width: 22m
Diameter: 15m
Weight: 14'500t

Mass: 14'200t
Diameter: 12m
Mass: 55m

- **Compact Muon Solenoid:**
 - One of 4 particle collision detectors at the LHC
 - Width: 22m, Diameter: 15m
 - Weight: 14,500 t
 - International collaboration of **2000** physicist

CMS Data Analysis

- Collisions occur at **40 MHz**
- Trigger reduces to **150 Hz**
- Output contains all recorded detector signals and derived information, called “Event”
- Events are analyzed separately
(**High degree of parallelization**)
- Estimated number of recorded and simulated events
 - 2007: **300 million**
 - 2008: **3 billion**
- Peta-scale data volumes
 - 2007: **640 TeraByte**
 - 2008: **6400 TeraByte**



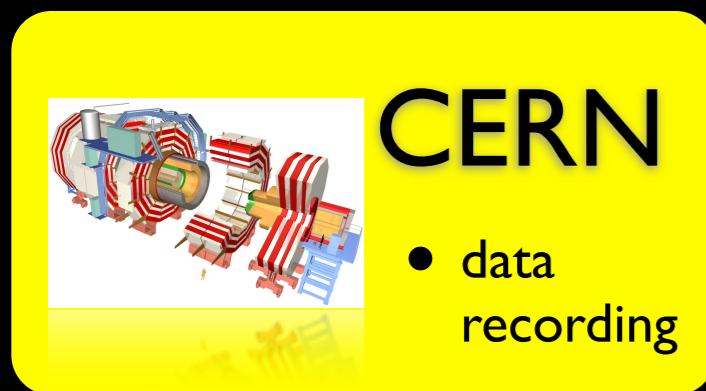
Data recording:
1.8 MB/evt.



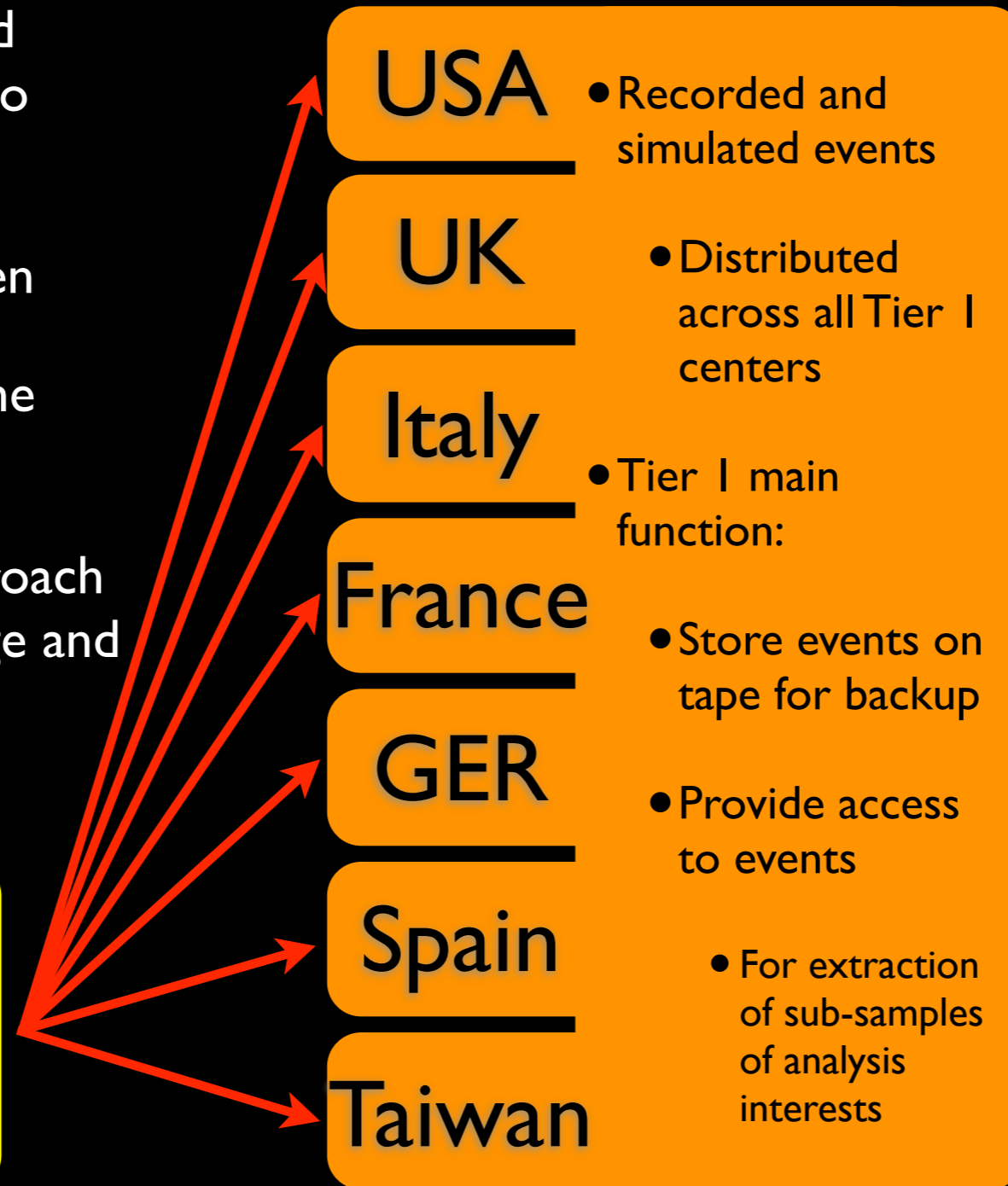
Simulation:
2.5 MB/evt.

CMS Tier Structure

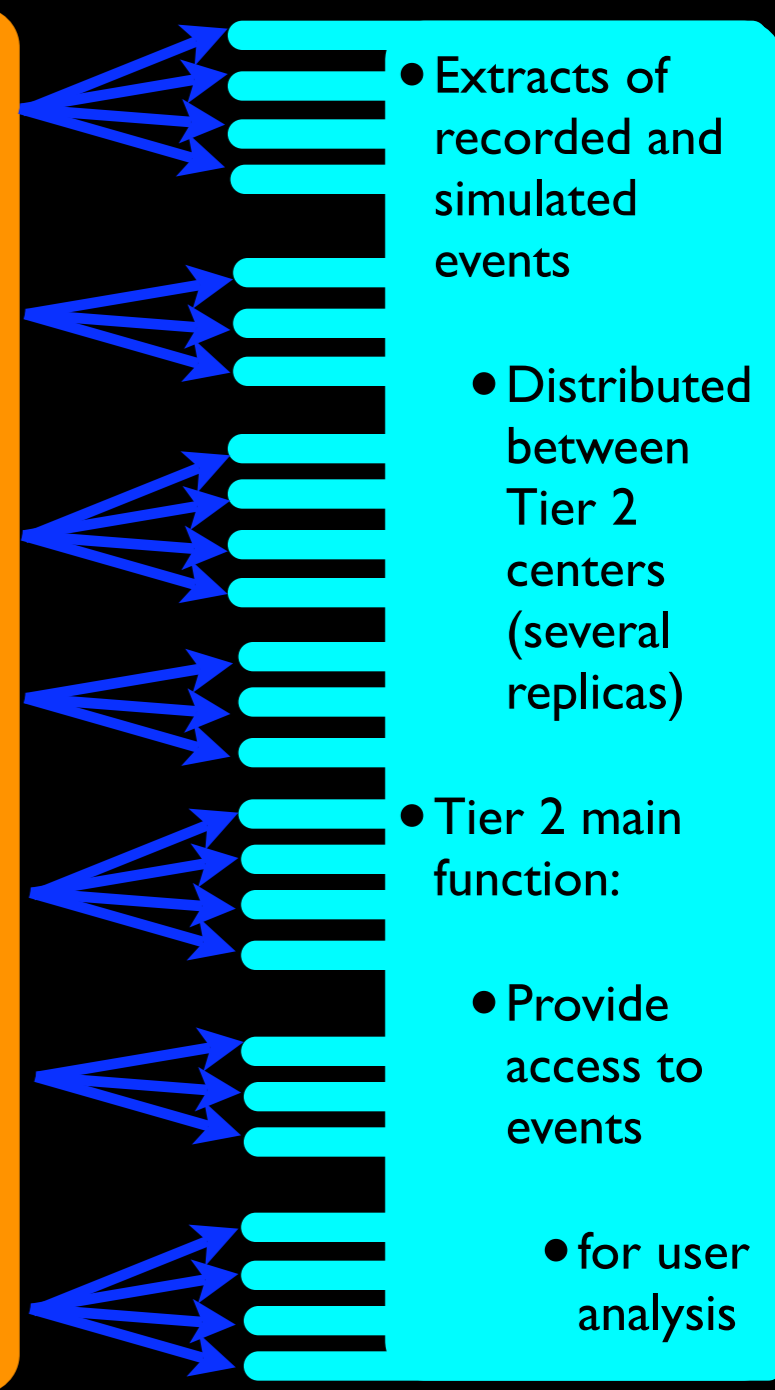
- 2000 physicists scattered around the globe want to analyze CMS data
- Analysis is location driven
 - “Job is sent where the data is stored.”
- CMS follows GRID approach to distribute data storage and processing world-wide



1 Tier 0



7 Tier 1



~25 Tier 2

Demonstration

[https://twiki.cern.ch/twiki/bin/view/Main/
MidWestGridWorkshop2007](https://twiki.cern.ch/twiki/bin/view/Main/MidWestGridWorkshop2007)